MUREP Small Business Technology Transfer (M-STTR) Planning Grants

Title: NASA STTR Planning Grant: Synthetic Mucins for Fulfilling NASA's Soft Materials Needs

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FY: 2022

SUMMARY:
The technology focus of this STTR planning grant will be synthetic mucins that can be used to fill diverse NASA soft material needs. Secreted mucus hydrogels are one of the most prevalent biomaterials. Every animal produces at least three, and some animal produce as many as 23, different mucuses. These biomaterials fill diverse roles, including adhesion, lubrication, and filtration, and, in doing so, have a central role in critical life processes, including growth, reproduction, food gathering or defense, and locomotion.

Primarily, their roles involve mediating interfaces between biotic/biotic or biotic/abiotic systems. Given their important biological roles, researchers are exploring animal-sourced mucuses as potential solutions for applications including coatings for implants, tissue repair, dermal patches, as filters, antiviral coatings, and protecting the skin from dehydration and radiation. Animal-sourced mucuses, however, suffer from batch-to-batch variability, contamination, and degradation during purification. As a result, researchers have attempted to develop mucus-inspired materials for applications include cartilage lubrication, meshes for ventral hernia repair, microbiome regulation, and drug delivery carriers. These materials, however, are based upon synthetic polymer backbones that lack biocompatibility and biodegradability, while failing to fully recapitulate the advantageous properties of the natural models.2 Given the widespread deployment of mucuses in nature as a solution to diverse soft-material needs, there are many NASA soft materials needs that could, and likely should, also be filled by synthetic mucuses as well. Ideally, synthetic mucuses should mirror the structure of natural mucuses, while at the same time be scalable and stable, and whose preparation relies on a synthesis that can precisely tailor and manipulate their physical properties.